2910222 Assignment 1 (2010/11)

Statement

This assignment aims to develop your experimental, data handling, presentation and analytical skills and your understanding of the ping utility and the causes of network delays.

Objectives

- To be able to carry out experiments using different features of the ping utility
- To be able to enter and display experimental results using spreadsheets
- To be able to analyse data, particularly relating measurements made to the different main types of delay (propagation, transmission and queuing delays)

Tasks

1. In order to complete this assignment, you must first find 10 host sites in 5 different countries in **Eastern Europe** and 5 different countries in the **Middle East** that respond to ICMP echo requests generated by ping commands. Please see the advice section for one way to go about this.

2. Using a PC at home or at your institution carry out Activity 6.3 of Volume 1 of the 2910222 Subject Guide to determine the Maximum Transfer Unit (MTU) of the that you can transmit. Find a host near to where you are that responds to a ping and start off by sending an ICMP echo request with 1500 bytes of data and has the Don’t Fragment bit set. Then send another similar ICMP echo request with 500 bytes of data. You will probably find that the first ping fails because the “packet needs fragmenting but DF bit set” while the second one succeeds. This means that the maximum data size lies somewhere between 500 and 1499. Now try 1000 bytes and determine whether the maximum data size is between 500 and 999 or between 1000 and 1499. Carry on this binary search process until you find the largest amount of data that can be transmitted without fragmentation, but where the packet with just one more byte fails. This is the largest amount of data an ICMP packet can carry which is less than the MTU size. Indicate what you think your MTU size is and why. Explain why your MTU size has been set to this value.

3. Using a PC at home or at your institution study the correlation between Round Trip Time (RTT) and packet size. Choose one of the 10 hosts you found, as far away from your location as possible and ping this site with different size packets. Start with a data size of 1400 bytes and then 1300, going down in steps of 100 bytes until you send a packet with 0 bytes. Enter the hostnames, RTTs and packet sizes into a spreadsheet table and draw an XY (Scatter) Graph to show the relationship between RTT and packet size. Draw the trendline and calculate the correlation between RTT and packet size.
Comment on your results, and explain why a positive correlation might exist between RTT and packet size with reference to the different components that might contribute to RTT (propagation, transmission and queuing delays).

4. Using a PC at home or at your institution study the correlation between Round Trip Time (RTT) and distance. Ping each of the 10 sites you found above and record the average RTT from the ping replies. Using an on-line distance calculator (such as www.indo.com/distance or http://www.geobytes.com/CityDistanceTool.htm) or an atlas, calculate the distance between your own location and the host site. Enter the hostnames, RTTs and distances into a spreadsheet table and draw an XY (Scatter) Graph to show the relationship between RTT and distance. Draw the trendline and calculate the correlation between RTT and distance. Comment on your results, and explain why a positive correlation might exist between RTT and distance with reference to the different components that might contribute to RTT (propagation, transmission and queuing delays).

Advice

Finding sites to ping is getting harder, as many network managers have responded to security concerns by filtering ICMP echo request packets. However, there are still many sites that do respond to pings, particularly on academic networks. You can obtain the website URLs of universities in the region from http://www.braintrack.com/ and selecting appropriate countries in the Eastern Europe and Middle East regions. Then use the ping facility on the operating system of your computer to generate an ICMP echo request packet to the hostnames that you found. If the site is filtering ICMP echo request packets, ping will time out. If replies are received, you should note the domain name for subsequent use.

In order to capture the output of ping commands, you can use the > or >> operators provided on most operating systems that use a command line to direct output of commands into files.

Avoid pinging hosts on your local LAN or too close to your own site. Some implementations of ping do not measure RTTs of less than 10ms.

If during any experiment, any packets are lost, repeat the experiment, as the lost packets will affect the average RTT.

If in any experiment, you fail to achieve a good correlation, repeat the experiment, in case some of the measurements were unrepresentative and if they are consistent, try to eliminate some of the outlying points and produce other tables and charts showing geographical or other subsets of the results.
Deliverables and Marking

Your submission should take the form of a report on your experiments carried out in tasks 2 to 4. The submission should contain between 1,000 and 2,000 words. Task 1 is required just to identify the hosts that you are going to use for the experiments and does not have to be written up. For each experiment you should describe the method, display the results in a well-formatted table and, where appropriate, in graphical form and analyse the results you have obtained. Finally you should write a conclusion bringing and summarising what you have learnt from the experiments.

The marking scheme is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
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<tbody>
<tr>
<td>2</td>
<td>Experiment 1 – MTU size</td>
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<tr>
<td>2.1</td>
<td>Method</td>
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<td>2.2</td>
<td>Results</td>
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<td>Analysis</td>
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<td>3</td>
<td>Experiment 2 – RTT v Packet Size</td>
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<td>5</td>
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Total 100%
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DIPLOMA AND BSc IN COMPUTING AND RELATED SUBJECTS
FOR INTERNATIONAL PROGRAMMES STUDENTS

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Unit title: ...........................................................................................................................................................................

Unit number: ...................................................................................................................................................................

Assignment number: ........................................................................................................................................................

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☐ signed and dated the Declaration?

☐ put your name and student number on every page?

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2910222 Assignment 2 (2010/11)

Statement

This assignment aims to further develop your experimental, data handling, presentation and analytical skills and your understanding of the traceroute utility and the causes of network delays.

Objectives

- To be able to describe how traceroute works
- To be able to carry out experiments using the traceroute utility
- To be able to enter and display experimental results using spreadsheets
- To be able to analyse data, particularly relating measurements made to the different main types of delay (propagation, transmission and queuing delay)

Tasks

1. Using a PC at home or at your institution carry out Activity 6.4 of Volume 1 of the 2910222 Subject Guide to investigate the effect of changing the initial value in the Time To Live (TTL) field in an ICMP echo request packet. Choose one of the 10 hosts from the list of hosts you used in Assignment 1 and ping it with an initial TTL of 1 and note the IP address from which the TTL expired message was received. Increment the initial TTL by 1 and repeat the experiment. Carry on incrementing the initial TTL by 1 each time until a reply is received from the host being pinged. Your submission should include a list of the IP addresses (and hostnames, if given) of all of the devices that have sent TTL expired messages. Read about the use of the TTL field and describe the reason for its existence and how it is now implemented in routers. Describe how the process you followed above has been used to implement the traceroute programme that is used by network managers to trace the route between a source and destination host.

2. Carry out traceroutes (the command is tracert in DOS/Windows) to each of the 10 hosts you pinged in Assignment 1. Study the routes followed by the packets to these hosts. Draw a map showing the complete routes to the 10 hosts including the names and IP addresses of all the routers that responded. Comment on any peculiarities that may account for some of anomalous results you may have obtained in Assignment 1.

3. Using a PC at home or at your institution study the correlation between Round Trip Time (RTT) and hop count. The hop count is the number of routers that a packet goes through before reaching its destination. It is the number that appears in the first field of the penultimate line of the traceroute output. Look at the traceroute output from 2 above and enter the hostnames, RTTs and hop counts into a spreadsheet table and draw an XY (Scatter) Graph to show the relationship between RTT and hop count. Draw the trendline and calculate the correlation between RTT and distance. Comment on your results, and explain
why a positive correlation might exist between RTT and hop count with reference to the different components that might contribute to RTT (propagation, transmission and queuing delays). Compare the correlation you obtained in this experiment with the correlation you obtained against distance in Assignment 1. Comment on why these correlations might be different.

Advice

In order to capture the output of traceroute commands, you can use the > or >> operators provided on most operating systems to direct output of commands into files.

Sometimes routers do not issue TTL expired messages. When this happens a line with three stars appears in the traceroute output. If this happens, you should label the routers as unknown. If the host has not been reached before traceroute gives up, then find another host instead which can be reached by traceroute.

Deliverables and Marking

Your submission should take the form of a report on your experiments carried out in tasks 1 to 3. The submission should contain between 1,000 and 2,000 words. For each experiment you should describe the method, display the results in a well-formatted table and, where appropriate, in graphical form and analyse the results you have obtained. Finally you should write a conclusion bringing and summarising what you have learnt from the experiments.

The marking scheme is as follows:

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<td>Analysis</td>
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<td>3</td>
<td>Experiment 2 – Routes</td>
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<td>4</td>
<td>Experiment 3 – RTT v Hop Count</td>
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2910222 Assignment 3 (2010/11)

Statement

This assignment aims to develop your skills at using market analysis tools to
analyse networking markets and to strengthen your research, analytical and
report writing skills.

Objectives

- To be able to research a company that operates within a networking market
- To be able to carry out Five Forces, SWOT and PEST analyses
- To be able to analyse generic, growth, product and partnership strategies

Tasks

You are to carry out an analysis of Telefonica’s positioning in the global
Mobile Telecommunications market as outlined below, by visiting the
Telefonica’s and other websites or by reading about Telefonica in books and
papers.

The output of the study should be documented as bullet point lists or tables
under the headings described in the Deliverables and Marking section.

Advice

Any text taken from websites or other published works must be enclosed in
quotation marks and the source acknowledged. Failure to do this will be
regarded as plagiarism.

Deliverables and Marking

The submission should contain between 1,000 and 2,000 words. The bullet
points should be written in such a way that the point being made is clear and
unambiguous.

Marks will be awarded for evidence of an understanding of the market being
studied and the use of various tools to analyse the market.

The marking scheme will be as follows:
<table>
<thead>
<tr>
<th></th>
<th>Introduction &amp; Main Products</th>
<th>5%</th>
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</thead>
<tbody>
<tr>
<td>2.</td>
<td>Main Competitors</td>
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<tr>
<td>3.</td>
<td>Five Forces Analysis</td>
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<td>4.</td>
<td>PEST Analysis</td>
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<td>6.</td>
<td>Generic Strategy</td>
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<tr>
<td>7.</td>
<td>Growth Strategy</td>
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<tr>
<td>8.</td>
<td>Product Strategy</td>
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<td>9.</td>
<td>Partnership Strategy</td>
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<td>10.</td>
<td>Conclusion</td>
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Statement

This assignment aims to develop your skills at designing and costing a simple network solution based on a set of requirements.

Objectives

- To be able to turn a set of requirements into a network design
- To be able to cost a design using a network operators’ price list
- To be able to produce a spreadsheet cost model

Tasks

You are a designer working for a consultancy called Netskill Ltd and you have a brief to design a new network for a client.

The client is Greenfield Enterprises Ltd and it is a medium sized start-up company that wants to establish offices in 6 UK cities (Belfast, Birmingham, Cardiff, Glasgow, Leeds and London).

You have carried out an analysis of the likely traffic between each of the sites and have produced a traffic matrix that has been agreed with the client. You are to use this to design and cost a Private Circuit network that is cost effective. Do not provide redundant circuits to increase resilience.

The predicted capacities required between each site are given in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Belfast</th>
<th>Birmingham</th>
<th>Cardiff</th>
<th>Glasgow</th>
<th>Leeds</th>
<th>London</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belfast</td>
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<td>25</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Birmingham</td>
<td>100</td>
<td>75</td>
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<td>125</td>
<td>150</td>
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<tr>
<td>Cardiff</td>
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<td>Glasgow</td>
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<td>Leeds</td>
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<td>London</td>
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</table>

You are also asked to outline some alternative technology designs which could be evaluated further. Do not attempt to cost these designs.
Advice

The BT Price List for Frame Relay can be found at: http://www.bt.com/pricing/current/FrameStream_boo/0868_d0e1.htm#0868-d0e1, but care must be taken to calculate the correct prices.

For the London site you should use Central London Zone (CLZ) prices and for all the other sites, you should use CityZone prices.

Do all your costings exclusive of Value Added Tax (VAT).

Assume a three year contract, so calculate the total cost over a three year period and apply the appropriate level of discount.

Deliverables and Marking

The submission should contain between 1,000 and 2,000 words. It must contain the following section headings and numbering scheme:

<table>
<thead>
<tr>
<th>Section No</th>
<th>Heading</th>
<th>Contents</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>Set the scene for the designs</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>Design</td>
<td>Draw a map showing the topology, describe the design and identify its strengths and weaknesses</td>
<td>30%</td>
</tr>
<tr>
<td>3</td>
<td>Alternative Solutions</td>
<td>Outline some other potential designs which could be evaluated, but do not attempt to cost them</td>
<td>10%</td>
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<tr>
<td>4</td>
<td>Conclusion</td>
<td>Summarise the main benefits of the design</td>
<td>10%</td>
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<tr>
<td></td>
<td>Costings</td>
<td>Submit a separate spreadsheet that clearly shows your cost calculations and the final total for the design.</td>
<td>40%</td>
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</table>

100%
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